

AGRICULTURAL MACHINE FOR GROUPING PRODUCTS LYING ON THE GROUND

The present invention relates to an agricultural machine for grouping products such as grass, hay or straw lying on the ground. In particular it has a main frame supporting a first gathering device and a second gathering device which are situated one beside the other during work and to which a first swathing device and a second swathing device are respectively associated.

Said swathing devices receive the products picked up by the gathering devices. They may cooperate to form a central swath laid down between them or to form a lateral swath laid down on one of the sides of the machine. In the latter case, it is possible, by making an outward and a return way with the machine, to group a large quantity of products in the same swath.

A known machine of this kind can be used essentially for picking up products that are already in two swaths in order to group them into one swath of greater volume. Accordingly, the possibilities of use of this machine are relatively restricted.

The particular aim of the present invention is to propose a machine as described in the introduction and which can also gather across a great width the products that are spread across the whole surface of the ground. This is particularly the case when it involves grass that has been cut and deposited in small swaths or spread out to improve drying.

For this purpose, an important feature of the invention consists in the machine comprising separation means situated in front of the inner ends adjacent to the gathering devices. These means separate the products spread on the ground and clear the strip of land

situated between the two gathering devices so that they can move forward.

Said separation means advantageously direct the moved products toward the gathering devices. They thus avoid losses of products between said devices and prevent products becoming caught on or wound around the inner edges and on the carrier wheels of these devices.

According to another feature of the invention, the machine comprises separation means situated in front of the outer ends of the gathering devices. These means clear the strips of land situated at the two ends of the machine. They also further the movements of the gathering devices and increase their working width.

The aforementioned separation means may consist of members such as raking disks or drums.

Other features and advantages of the invention will emerge from the claims and the description that follows of nonlimiting exemplary embodiments of the invention, with references to the appended drawings in which:

- figure 1 represents a top view of a first exemplary embodiment of a machine according to the invention;
- figure 2 represents a side view of the machine according to figure 1;
- figure 3 represents a top view of a second exemplary embodiment of a machine according to the invention;
- figure 4 represents a side view of the machine according to figure 3.

As it is represented in figures 1 and 2, the machine according to the invention comprises a main frame (1). The latter consists of a central beam (2) which has at its front end a coupling system (3) for attaching it to a towing tractor and, at its rear end, a cross-beam (4)

with two traveling wheels (5 and 6) which rest on the ground. On this beam (2) two arms (7 and 8) are articulated with the aid of axes (9 and 10) which are substantially parallel to the beam (2). These arms (7 and 8) are additionally connected to the beam (2) by means of hydraulic rams (11 and 12) which enable them to move about said axes of articulation (9 and 10).

The first arm (7) extends, when seen in the direction of travel (A), to the right side of the beam (2) and carries a frame (13) to which are connected a first gathering device (14) and a first swathing device (15) which is associated with said first gathering device (14) and is situated immediately behind the latter. The other arm (8) extends to the left side of the beam (2) and carries a frame (16) to which are connected a second gathering device (17) and a second swathing device (18) which is associated with said second gathering device (17) and is situated immediately behind the latter. As can be seen in figure 1, in the working position, the two gathering devices (14 and 17) are substantially aligned and are situated at a short distance one from the other. They consist of pick-ups (19 and 20) driven by hydraulic motors (21 and 22) and carried by wheels (23 to 26) which rest on the ground. The swathing devices (15 and 18) consist of conveyor belts (27 and 28). These are driven by hydraulic motors (29 and 30) whose direction of rotation can be reversed. These conveyor belts (27 and 28) can be moved laterally on the frames (13 and 16) in order to change their spacing. These frames (13 and 16) are advantageously articulated on the arms (7 and 8) and in addition have wheels (31 to 34) which rest on the ground.

The beam (2) also carries separation means (35) situated in front of the inner ends adjacent to the gathering devices (14 and 17). These means (35) consist of two raking disks (36 and 37) each of which being

able to rotate about an axis (38 and 39) which is substantially horizontal and oblique relative to the direction of travel (A). Each of these raking disks (36 and 37) consists of a circular support (40) fitted with teeth (41) on its entire periphery. They are placed in such a way as to practically form a V whose point is pointing in the direction of travel (A). Their trajectories may however partially overlap in the zone situated under the beam (2). Accordingly, they may be slightly offset from one another in the direction of travel (A) and be placed such that the raking disk (37) that is furthest rearward extends partially behind the other disk (36) (see figure 1).

These raking disks (36 and 37) are connected to supports (42 and 43) which are articulated by means of axes (44 and 45) on the beam (2). Said axes of articulation (44 and 45) are substantially horizontal and allow the disks (36 and 37) to move heightwise (see figure 2). The latter may then be in contact with the ground and be driven in rotation due to their friction of motion with said ground when the machine is moved in the direction of travel (A).

According to an alternative embodiment not represented, the separation means consist of a single raking disk (36 or 37) of greater diameter which is able to rotate about an axis that is substantially horizontal and oblique to the direction of travel (A).

In the exemplary embodiment according to figures 3 and 4, the separation means (35) consist of two raking drums (46 and 47) rotating about substantially vertical axes (48 and 49). These drums (46 and 47) are placed side by side and are connected to the beam (2). They are driven in rotation in such a way as to turn away from one another at the front (arrows B and C) by means of hydraulic motors or transmission shafts which are driven from the power take-off shaft of the tractor.

Each drum (46, 47) is made up of a cylindrical body (50) which carries at its lower part a flexible skirt (51) to pick up and move the products lying on the ground. The cylindrical body (50) of each drum (46, 47) also carries driving elements (52) which are situated above the corresponding flexible skirt (51) and further the movement of the products.

According to an alternative embodiment not represented, the beam (2) carries only one drum (46 or 47) of greater diameter in order to separate the products.

The machine according to the invention may in addition comprise separation means (53) situated in front of the outer ends of the gathering devices (14 and 17). These may involve raking disks or drums complying with those described above. In the example shown in figure 1, each gathering device (14, 17) carries at its outer end an arm (54, 55) which is directed obliquely forward and outward. On each of these arms (54, 55) is articulated a support (56, 57) fitted with a raking disk (58, 59) which is disposed obliquely relative to the direction of travel (A) in order to move the products from the outside toward the corresponding gathering device (14, 17). These raking disks (58 and 59) are comparable to the aforementioned raking disks (36 and 37). They may be driven in rotation about their axes (60 and 61) by the friction motion with the ground.

These raking disks (58 and 59) may also be replaced by substantially vertical raking drums which are driven in rotation by hydraulic motors.

During work, the machine is attached to a tractor which moves it in the direction of travel (A). The front part of the beam (2) is lowered relative to the tractor until the separation means (35) touch the ground. The arms (7 and 8) are lowered to a substantially

horizontal position with the aid of hydraulic rams (11 and 12) such that the wheels (23 to 26 and 31 to 34) run on the ground. When the machine according to the example in figures 1 and 2 moves forward, the raking disks (36 and 37) are driven in rotation about their axes (38 and 39). They then separate the products which they encounter and move them to the right and to the left toward the pick-ups (19 and 20). Thus these raking disks (36 and 37) clear a strip of land whose width is at least equal to the distance between the two pick-ups (19 and 20) so that all the products in the trajectory of the machine reach the zones of action of said pick-ups (19 and 20).

The two raking disks (58 and 59) which are situated at the outer ends of the pick-ups (19 and 20) also rotate about their axes (60 and 61) due to the friction motion with the ground. They then push the products that they encounter toward the middle of the machine, in front of their respective pick-ups (19 and 20) and clear a strip of land either side of the machine.

Said pick-ups (19 and 20) are then driven by the hydraulic motors (21 and 22). They gather the products on the ground and move them upward and rearward onto the conveyor belts (27 and 28). The latter are also driven by their hydraulic motors (29 and 30) so that they move in the same direction indicated by the arrows (F and F'). The second conveyor belt (28) then dispatches its products to the first belt (27) which deposits all the products in the form of a lateral swath on the right-hand side of the machine. It would naturally be possible to deposit the swath on the left-hand side of the machine simply by reversing the direction of movement of the conveyor belts (27 and 28). To form a central swath, it is sufficient to separate the two conveyor belts (27 and 28) and reverse the direction of movement of the first belt (27). In this case, the products fall back onto the ground in

the form of a swath passing between the two conveyor belts (27 and 28).

In the example according to figures 3 and 4, the raking drums (46 and 47) are lowered, by means of the beam (2), until their skirts (51) touch the ground. Then, they are driven in the direction of the arrows (B and C) and move the products they encounter toward the outer sides and deposit them in front of the two pick-ups (19 and 20). They thus clear the products situated on the central strip of land so that all the products can be collected by the pick-ups (19 and 20) as has been described above for the example of figures 1 and 2.

The machine according to the invention is used to group into a large-volume swath the forage that was previously over a great width and this can be done without, for the most part, the forage being moved along the bare ground which could make it dirty. This grouping also makes it possible to reduce the number of passes with harvesting machines such as balers and forage harvesters.

For transport, the front of the beam (2) is raised to move the separation devices (35) away from the ground. Then the two arms (7 and 8) with the gathering devices (14 and 17) and the swathing devices (15 and 18) are raised to the vertical position about the axes of articulation (9 and 10).

It is clear that the invention is not limited to the embodiments described above and represented in the appended drawings. Modifications are possible, particularly with respect to the make-up or number of the various elements or by substituting equivalent techniques, without however departing from the field of protection defined by the claims.